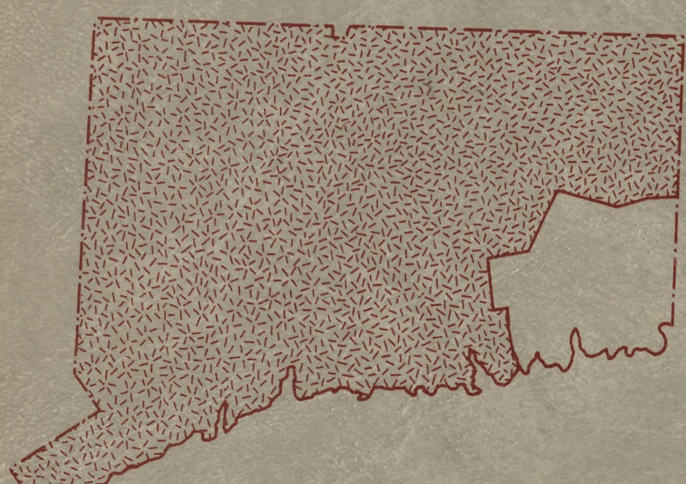
LAND CHARACTERISTICS



1963

SOUTHEASTERN CONNECTICUT
[illegible]ONAL PLANNING AGENCY

LAND CHARACTERISTICS

Southeastern Connecticut Region

The preparation of this report was financed in part through an Urban Planning Grant from the Housing and Home Finance Agency, under the provisions of Section 701, of the Housing Act of 1954, as amended, and through a regional planning grant from the Connecticut Development Commission.

Southeastern Connecticut Regional Planning Agency
139 Boswell Avenue, Norwich, Connecticut

June, 1963

SOUTHEASTERN CONNECTICUT REGIONAL PLANNING AGENCY

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GENERAL CONCLUSION

Historically, man always has been closely related to, and influenced by, his physical environment. But in this century, and particularly in this country, man has broken away from his physical environment. In some instances this break has been made possible and justified by technological advances. In others, when the physical limitations imposed by the land's surface have been ignored, it has resulted in inconvenience, suffering, and financial loss.

The natural environment is no longer the limiting factor that it once was. But in spite of technological achievements, it is apparent that a knowledge of the environment in which we live is still important. It is important because the process of urbanization changes natural balances in the environment, because it results in a far more intensive use of the land than was common in the past, and because larger concentrations of people than ever before can be affected by a failure of the environment to withstand a change imposed on it by man.

As Southeastern Connecticut develops more fully in the future, its attractiveness and much of its environmental quality will be determined by how well we have understood, respected, and utilized the potentials and limitations of the land's surface.

This report is a first effort to inventory and evaluate those potentials and limitations of the land surface of Southeastern Connecticut in their relationship to man's needs. The major findings and conclusions reached during the study include the following:

Land characteristics have had a strong influence on the present pattern of development in Southeastern Connecticut. Construction problems in areas of rough topography have limited the major portion of the region's development to the more level lands. Slopes greater than 10% will continue to present obstacles to intensive development. However, left in their natural, tree-covered state, the steeper slopes could enhance the development potential of adjacent level lands and become a real asset.

The abundant surface waters of our inland lakes and streams are a necessary resource to all of the social and economic activities of the region. The need for developing this resource will grow along with the residential, com-

mercial, and industrial growth of the region.

Water pollution and, to a lesser extent, the threat of future flood damage are two problems affecting our inland waterways at present. A comprehensive study of pollution is necessary before any effective corrective program can be initiated. Measures are already available for coping with flooding. These include Small Watershed Projects, flood plain zoning, and the preservation of flood-prone areas for recreation or conservation use. None of these approaches has been used to any extent in the region to date.

The coastal margin of the region includes many features worthy of preservation because of their recreation, conservation, or scenic potential.

In particular, the bathing beaches along the coast are among our most valuable natural assets. At present there are in the region only two beaches - Ocean Beach Park and Rocky Neck State Park - available for use by the general public. Our expanding population, which now totals about 185,000 persons, probably will require additional beach facilities in the future.

The maintenance of existing beaches has been the subject of considerable study by the U.S. Army Corps of Engineers. In brief, their studies conclude that the most effective means of coping with beach deterioration in the region is the artificial replenishment of beach sand from on- or off-shore deposits.

Southeastern Connecticut has a large potential for future growth. More than four-fifths of the region's 511-square-mile land area remain in an undeveloped state. This undeveloped land constitutes a reserve of space nearly 4.5 times the amount of land now occupied by development and public open space.

On the basis of soil characteristics and slope, the undeveloped land has been separated in this report into two categories:

(1) <u>Class A Undeveloped Land,</u> which presents few physical obstacles to intensive development and

(2) <u>Class B Undeveloped Land,</u> which presents physical obstacles to intensive development because of soil, drainage, and slope conditions.

The Class A Undeveloped Land, totalling 163 square miles, can be termed the prime buildable land of the region. This land is likely to attract the greatest portion of future growth within Southeastern Connecticut.

Class A land is scattered and fragmented throughout much of the region. The clustering of development on scattered pockets of the Class A land and the use of Class B land for open space needs could be an efficient means of making the most of the region's land surface in the future.

Regional growth is expected to continue to be concentrated in the Development Core, which now contains 77% of the region's development. The reserve of Class A land in the Development Core should be adequate to accommodate a population several times that of the Core at present.

Class B Undeveloped Land accounts for 254 square miles. Although this land presents problems for development, it is obvious that some of this area will be built on in the future. The greatest pressure for development of the Class B land will be felt in the Development Core. Where public water and sewerage systems are provided, Class B land can be developed in conjunction with Class A land to create a cohesive community. Where water supply and sewage disposal are provided for on individual lots, scattered, large-lot development appears, with present technology, to be the only feasible form of development on Class B land.

While the Class B land presents obstacles to development, it is in many respects ideally suited for open space and recreation uses. The Class B land is a logical site of many of the region's future open space facilities, especially those requiring a large area.

Much of Southeastern Connecticut's land surface also has a specialized potential for agriculture, water supply, conservation, or recreation. Particular consideration should be given to exploiting this potential.

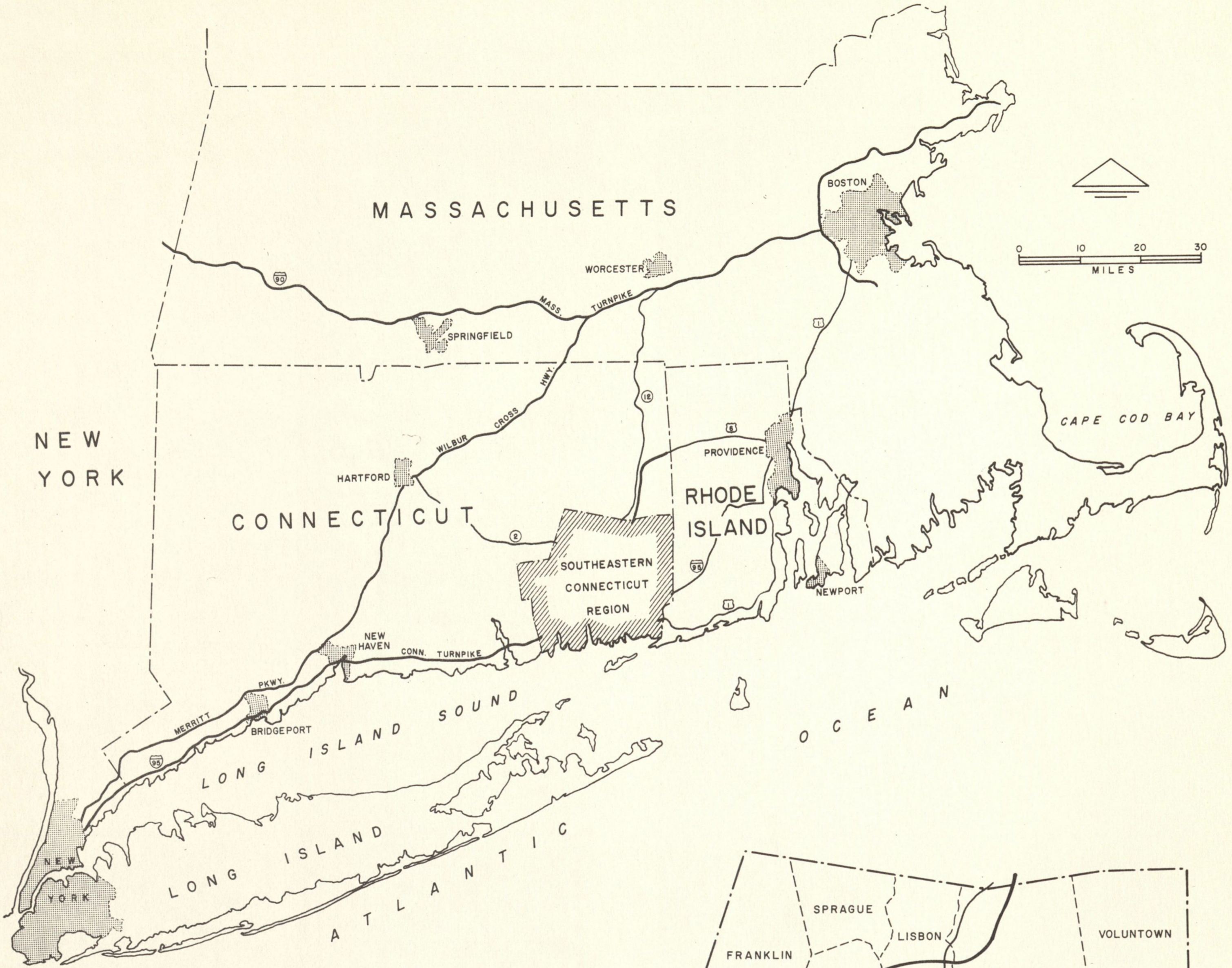
Prime agricultural land, consisting of large concentrations of agriculture, out of the immediate path of development, and on good quality agricultural soils, accounts for 33 square miles of the Class A land. Conversion of some of this land to house lots will continue. However, further study by SCRPA will evaluate the economic feasibility of encouraging the maintenance of agriculture as a major land use in this region.

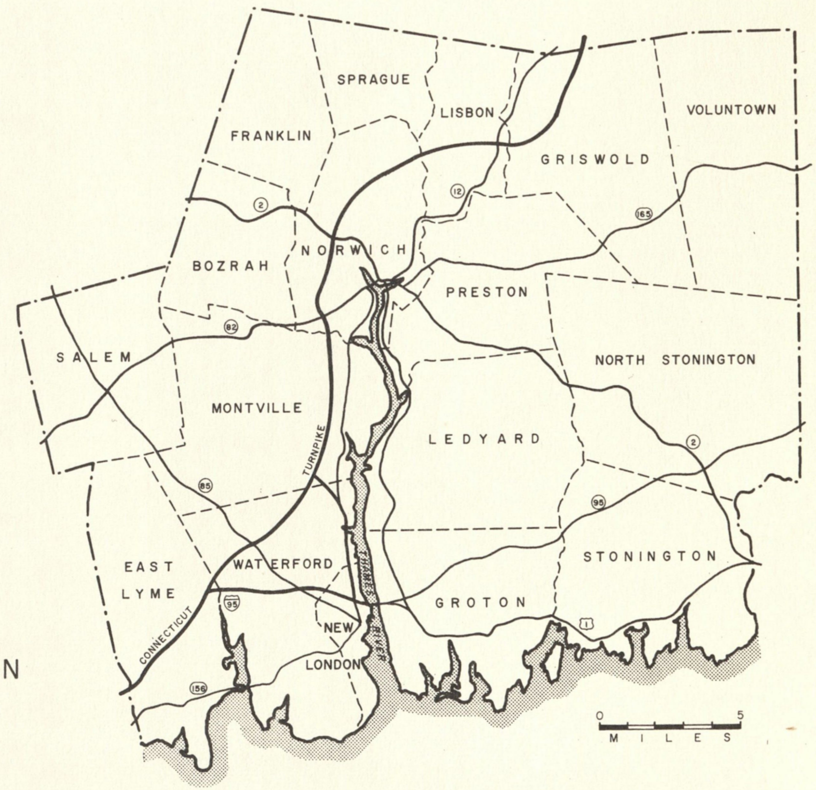
Tidal marsh areas and interior wetlands present problems to development but have an exceptionally high

conservation potential. These, along with several topographic features of geologic interest, merit consideration in an open space program, and they will be examined more closely in a special open space and recreation study to be conducted by SCRPA shortly.

Potential reservoir sites exist to more than meet the anticipated water needs of the region in the year 2010. An adequate water supply is one of the keys to the future growth of Southeastern Connecticut, and the preservation of the most highly rated potential reservoir sites is the key to an adequate future water supply. A regional water authority offers the most comprehensive means of developing the region's abundant water resources.

These facts demonstrate that Southeastern Connecticut has an abundance of land physically suited for future development and open space use. A major objective of both local plans and the regional plan should be to recognize and utilize efficiently these natural assets.





LOCATIONAL MAP

SOUTHEASTERN CONNECTICUT REGION

FIGURE I

PREPARED BY THE SCRPA STAFF - 1962

I. INTRODUCTION

PURPOSE

STUDY METHODS

ACKNOWLEDGEMENT

PURPOSE

In this second report of the research phase of the regional planning program we are concerned with analyzing the physical limitations and advantages of the region's land surface. While our first study, Land Use: Patterns and Policies, published in 1962, showed how the land is presently being used, this report is concerned with what the land is physically most capable of supporting in the future.

Our purpose is threefold:

(1) to review the relationship between the present pattern of development and the general physical structure of the region,
(2) to evaluate the broad physical potential of presently undeveloped land for future developed or open space uses, and
(3) to inventory and assess specialized land types that have a high potential for agriculture, water supply, open space and recreation, and wildlife conservation use.

This report should not be confused with a plan. It is but one in a series of studies being made by the agency prior to the drafting of a plan. Future studies by the agency will attempt to determine what ingredients are necessary in the region to ensure orderly social and economic growth. When these basic studies have been completed, the agency will then be able to formulate a development plan based on fact. Only such a plan will have a good chance of achieving success.

STUDY METHODS

The research materials used in preparing this report were of a varied nature.

(1) General Soil Maps at a scale of one inch to 2,000 feet were prepared for each town in the region by the Soil Conservation Service of the Department of Agriculture. 1/ The preparation of these maps is based on available soil survey information, interpretations of

1/ These maps were prepared principally by David Thompson, Soil Scientist, Soil Conservation Service.

U.S. Geological Survey topographic maps and aerial photographs, combined with some field observations. These delineations are based on soil associations which consist of combinations of different soils. The maps have value for overall planning purposes and as a general inventory of land resources in an area. For detailed information about the soils of specific areas or sites a Standard Soil Survey map or even more detailed studies are needed.

(2) Another primary source of information was a slope map of the entire region prepared by the SCRPA staff from U.S. Geological Survey topographic maps. The slope map shows: (A) land having a slope in excess of 20%, (B) land having a slope of from 10% to 20%, (C) land with a slope of less than 10%, and (D) swamps and marshes. 2/

The information obtained from the General Soil Maps and the slope map was combined with land use information onto a single map in an effort to determine the areas of the region physically most capable of supporting future intensive development, agriculture, or specialized conservation uses.

(3) Previous studies concerned with specialized aspects of the land's physical capabilities were also used as source material for this report. These included the Metcalf and Eddy report on fresh water resources prepared for the Southeastern Connecticut Industrial Fresh Water Development Commission and the Nature Conservancy study of tidal marshes in Connecticut.

(4) In addition, specialists in agriculture, wildlife management, and geology were consulted during the study to identify the amount and location of land in the region suitable for special activities closely related to the character of the land surface.

In order to make the material of this report more meaningful from a regional point of view, much of the data has been compiled and presented according to the Development Core - Rural Zone concept established in the land use report. In the land use study we found that there was a broad degree of order and organization to the distribution of development in the region. Functionally, the region is

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2/ For a more detailed discussion of the implications of slope on development see: The Community Builders Handbook published by the Urban Land Institute, Washington, D.C., 1960, and Site Planning by Kevin Lynch, the M.I.T. Press, Cambridge, Mass., 1962.

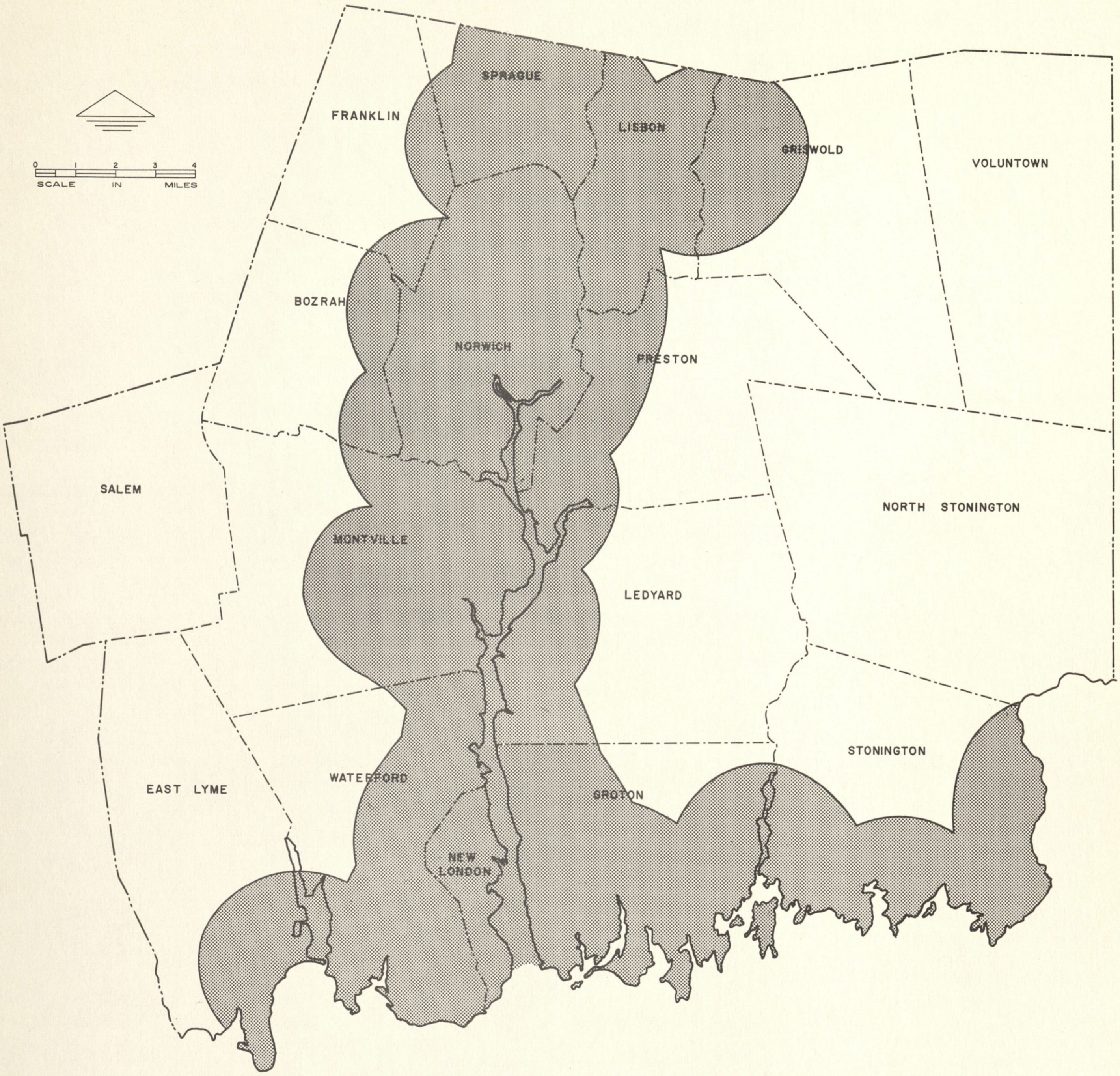
divided into two parts that cut across municipal boundaries: (1) a Regional Development Core, containing almost 77% of the urban and suburban development in the region, and (2) a Rural Zone, containing little development. These areas may be seen on the map on page 6.

The facts and conclusions presented in this report represent a basic tool for both regional and municipal planning. An awareness of the physical characteristics of the land surface should enable planners at all levels of government to better evaluate the uses to which the different types of land are most suited.

ACKNOWLEDGEMENT

The scope of this study required the assistance and cooperation of many specialized agencies and individuals. SCRPA wishes to take this opportunity to thank all those who contributed to this work. We are especially indebted to the following: Milton Arnold, Mason Belden, and James Bishop, State Board of Fisheries and Game; Richard Goldsmith, U.S. Geological Survey; Stanley Hale, New London County Agricultural Agent; Joseph Hickey, Connecticut Development Commission; Robert Laramy, Arthur Shearin, and David Thompson, Soil Conservation Service; Dr. Joe Webb Peoples, Wesleyan University; and Dr. J.B. Lucke and Dr. John Rankin, University of Connecticut.

SOUTHEASTERN CONNECTICUT REGION



REGIONAL ANALYSIS ZONES

DEVELOPMENT CORE

RURAL ZONE

FIGURE 2

701 PROJECT: CONN. P-30(G)

FINANCED IN PART THROUGH REGIONAL PLANNING GRANTS FROM THE HOUSING AND HOME FINANCE AGENCY AND THE CONNECTICUT DEVELOPMENT COMMISSION

PREPARED BY THE SCRPA STAFF – 1963

II. MAJOR PHYSICAL STRUCTURE OF THE REGION

TOPOGRAPHY

DRAINAGE PATTERN

COASTAL FEATURES

SUMMARY OF MAJOR FINDINGS

TOPOGRAPHY

One of the most obvious considerations in a study of physical characteristics is topography. The slope of the land, the location of streams and other water bodies, and the general character of the land surface - all have a significant influence upon the settlement pattern. An understanding of the topography of the land and of its influence on the pattern of development in the past will be a valuable tool in understanding the probable direction of growth in the future.

The topography of Southeastern Connecticut is varied and complex. The natural surface features were shaped by continental glaciers which covered New England during the latter part of the Pleistocene epoch in geologic history, ending about 25,000 years ago, and by erosion since that time. The resultant landscape is marked by numerous tree-covered hills, steep slopes, narrow stream valleys, rock outcrops, and a considerable number of swamps and marshes.

A lowland broken by small hills and ridges extends in a band three to four miles wide along the coast and in a narrow belt up the Thames River Valley as far north as Baltic and Jewett City. But most of the region is a hilly upland. Hills exceeding 500 feet above sea level are quite common in the interior towns of Voluntown, Franklin, Bozrah, Salem, and the western portion of Montville.

The map on page 9 shows how strongly the development pattern of the present conforms to the topographic structure of the region. Early settlements were located at the mouths of major streams in the coastal lowlands or at significant points along the stream valleys. The more recent growth extends out from the urban centers - without regard to municipal boundaries - to form a fairly continuous pattern of development along the coastal lowland and up the stream valleys. This is the Regional Development Core. In view of the considerable amount of undeveloped land remaining in this area, the Development Core will probably continue to have a rapid rate of growth.

Extreme elevations in the land surface do not exist in the region, but the steepness of slopes on the numerous hills has influenced the development pattern.

One hundred-fifty square miles of land, almost 30% of the area of the Southeastern Connecticut Region, lies on slopes greater than 10%. (A 10% slope is one which rises 1 foot in 10 linear feet.) Steep slopes are not a charac-

SOUTHEASTERN CONNECTICUT REGION

TOPOGRAPHY & DEVELOPMENT

LEGEND

ELEVATION ABOVE SEA LEVEL

- LESS THAN 200 FEET
- 200 TO 400 FEET
- OVER 400 FEET

DEVELOPED LAND

FIGURE 3

701 PROJECT: CONN. P-30(G)

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teristic feature of any one portion of the region, but are common to every town. Generally, the towns on the western side of the Thames River have a larger quantity of steep slopes than do the eastern towns. Bozrah, located in the northwestern part of the region, has 43% of its land area in slopes steeper than 10%, while Stonington, in the southeastern corner of the region, has only 12% of its land in this category.

Because of road building difficulties, the need for extensive site grading, and problems of on-the-lot sewage disposal, construction costs increase rapidly on lands having slopes in excess of 10%. The elimination of slopes by grading is a normal procedure in some areas prior to construction, but in this region the presence of rocky ledges at or near the ground surface of many of these slopes makes grading difficult and costly.

For this reason, the slope of the land has had an influence on the location of development in Southeastern Connecticut. A survey by the SCRPA staff disclosed that only 1,353 acres (or 4.9%) of the region's 27,852 acres of development are located on land with a slope greater than 10%. It is expected that slopes in excess of 10% will continue to be an obstacle to intensive development, although they may be utilized to some extent as a scenic setting for more expensive homes on large lots.

While there is not likely to be widespread development on the steeper slopes of the region, these slopes have some other potentials. The presence of slopes tends to prevent the continuous and monotonous suburban sprawl which has enveloped so much of the countryside adjoining metropolitan areas in other parts of the country. By preserving the steeper slopes as green belts between and within areas of development, the identities of individual communities could be enhanced. Lands which are too steeply sloped for easy development might be ideal park and recreation areas. They may also serve as natural barriers to screen unsightly uses in some communities.

The steep, tree covered hillsides are one of the region's most distinctive and valuable assets. Left in their natural state they add enormously to the attractiveness of the region. Spotted with housing or other uses, or otherwise stripped of their natural cover, they could discourage growth on adjoining level lands. It has been shown in many areas that the conservation of scenic natural features raises the development value of nearby lands.

DRAINAGE PATTERN

Surface waters have had a strong influence upon the growth of Southeastern Connecticut. The urban centers are adjacent to the coast of Long Island Sound and the shores of the major streams. Most of the remaining development extends out from the urban centers along the lesser stream valleys. Many of the lakes of the region are used for recreational activities or fresh water reservoirs. The major rivers and estuaries are used by commercial and military shipping as well as by a growing number of pleasure boats. At the present time, there is also a heavy dependence upon the rivers for the disposal of industrial and domestic sewage.

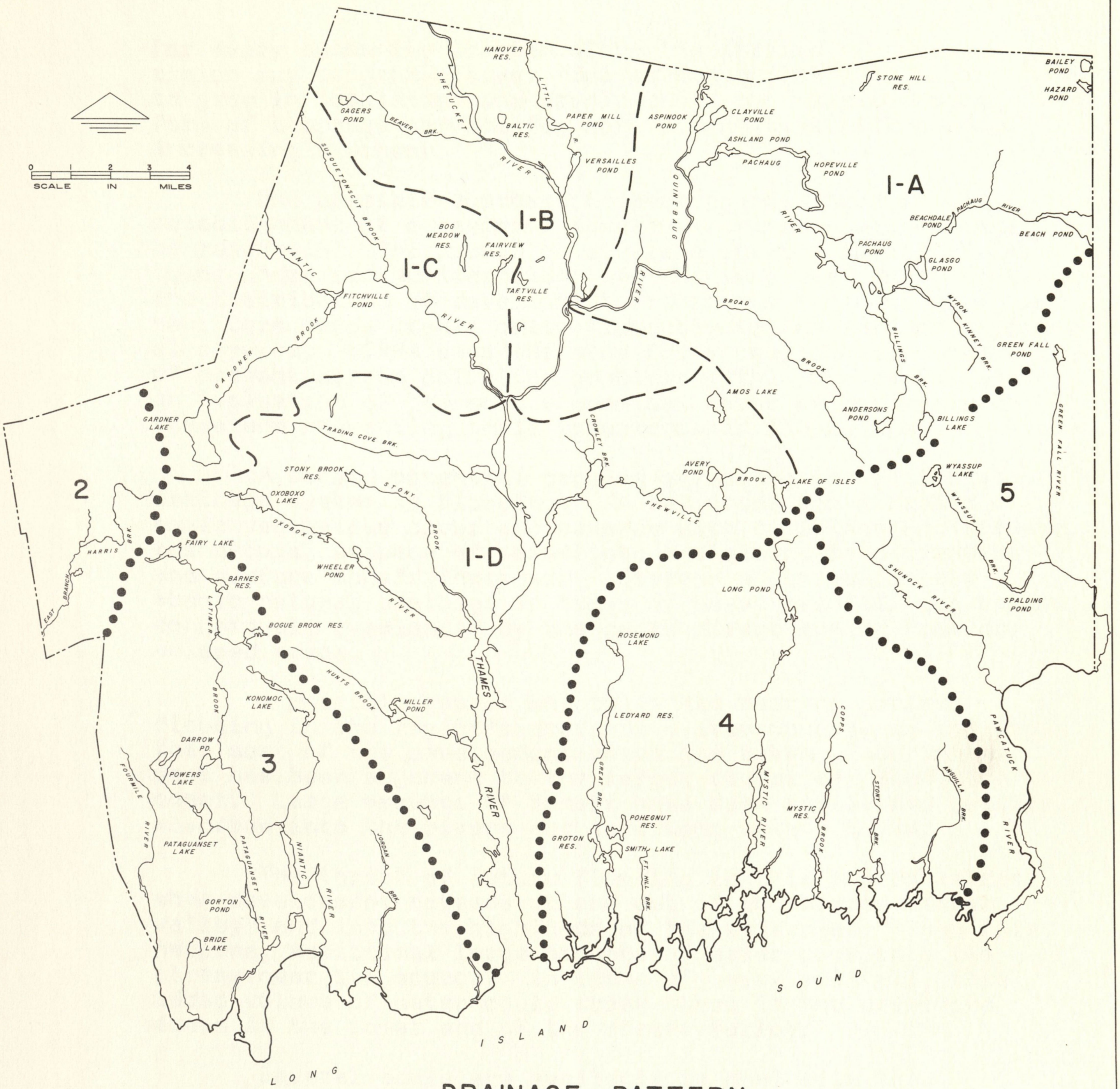
The importance of the surface waters will increase along with the growth of the region. Additional water supplies and a variety of water-oriented recreational facilities will be needed. Fortunately, Southeastern Connecticut is blessed with an abundance of surface water. An understanding of the present and potential uses of this important natural resource is essential before a regional development plan is formulated.

The most significant drainage feature in Southeastern Connecticut is the Thames River. This important waterway is fed by numerous small streams in its 14-mile course from Norwich to Long Island Sound. Two major streams converge to form the Thames River at Norwich. These are the Yantic River, which enters the region in Bozrah, and the Shetucket River, which enters in Sprague. The Shetucket in turn is fed by the Quinebaug River near Taftville.

The map on page 12 shows major drainage basins within the region and the major watersheds within this region's portion of the Thames River Basin. Together with its tributaries, the Thames River drains about 55% of the region's 511-square-mile land area. The western part of Salem is drained by the East Branch of the Eight Mile River and its tributaries, which flow ultimately into the Connecticut River. The streams in the two Coastal Drainage Basins flow directly into Long Island Sound, as do the waters of the Pawcatuck River Basin.

Several problems are inherent in this drainage system. One which has already created much controversy is stream pollution. Large quantities of untreated or partially treated sewage and industrial waste are dumped into our waterways every day. This not only affects marine life but poses a potential health problem to the residents of the region. The expense of providing sewage treatment plants

SOUTHEASTERN CONNECTICUT REGION



DRAINAGE PATTERN

LEGEND

●●●● DRAINAGE BASIN BOUNDARIES

— — MAJOR WATERSHED BOUNDARIES

I THAMES RIVER BASIN

I-A QUINEBAUG RIVER WATERSHED

I-B SHETUCKET RIVER WATERSHED

I-C YANTIC RIVER WATERSHED

I-D TIDEWATER DRAINAGE

2 CONNECTICUT RIVER BASIN

3 & 4 COASTAL DRAINAGE BASINS

5 PAWCATUCK RIVER BASIN

FIGURE 4

701 PROJECT: CONN. P-30(G)

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for every community located along the streams of the region may be prohibitive. But as the region continues to grow in population and development, the need for some form of sewerage service for more communities will become increasingly urgent.

One possible approach to meeting this need is the establishment of a regional sewerage authority which would be responsible for providing sewerage service to all of the towns under its jurisdiction. As the land use report stated, the distribution of development within the Regional Development Core lends itself quite favorably to the idea of regional service. SCRPA sees the need for a comprehensive study of present stream pollution problems within the region and an evaluation of the most economical means of dealing with these and preventing their recurrence in the future.

A second potential problem affecting the region's drainage system is flooding. As new areas are stripped of their vegetative cover and covered with buildings and streets, the natural seepage of water into the ground is disrupted and surface runoff increases. Streams which adequately absorb natural drainage in times of heavy rainfall can become dangerously overloaded by the rapid direct runoff from developed areas.

A possible reason why there has been no serious flooding in the region's drainage system to date is the fact that most of the development which has taken place in the past has been adjacent to the larger rivers and along the coast. Large amounts of runoff have been easily and quickly absorbed into the rivers and into Long Island Sound.

The threat of future flooding in this region arises when development spreads up and out of the narrow stream valleys and into the highlands of the watershed. When this happens, additional large amounts of water pour into the stream near its source. In times of heavy rainfall, this added volume of water could wreak havoc in the developed areas in the lower end of the stream valley.

Several tools are available to deal with this potential problem.

<u>Small Watershed Project.</u> In cases where development in the upper portion of a watershed is expected to reach significant proportions and where the lower portion of the watershed contains a substantial amount of damageable property, a small watershed project carried out with state

and federal aid may be justified. 3/ Such a project could include the construction of small floodwater retarding dams designed to hold excessive rainfall close to the area in which it falls. When the danger of flooding had passed, the water held behind the retarding dams would be released. A project of this type could be designed to meet recreation, conservation, or water supply needs in addition to providing flood protection. The Town of Montville currently has an application pending for a study of the feasibility of a small watershed project in the Oxoboxo River Watershed.

Flood Plain Zoning. Flooding usually does not take on serious proportions unless the area inundated contains damageable property. One obvious way to reduce the possibility of flood damage is to avoid building in areas likely to be flooded. Connecticut permits municipalities to regulate land use in flood plains, 4/ which are the portions of watersheds most likely to be flooded. Through the use of flood plain zoning, a municipality may prohibit the location of damageable activities and structures in the flood plains of its stream valleys. This is by far the most economical means of dealing with a potential flooding problem, although it may not be the only means called for in some cases. A topographic survey by SCRPA indicates that there are about 2,400 acres of flood plain in the region. 5/ None of this has been zoned to prohibit the building of damageable structures.

Local Open Space Programs. Local open space areas proposed within the town plan of development or the open space program of the local Conservation Commission could include flood-prone areas. Recreation or conservation activities may be the most appropriate use of much of the region's flood-prone land.

3/ Connecticut Agricultural Extension Service. Connecticut's Small Watershed Program. Storrs, Conn., 1963.

4/ Section 8-2, Chapter 124 of the Connecticut General Statutes, 1958 Revision, as amended.

5/ Municipalities with flood plains are: Bozrah, 771 acres; Griswold, 92 acres; Lisbon, 230 acres; Montville, 37 acres; North Stonington, 312 acres; Norwich, 615 acres; Preston, 64 acres; Sprague, 156 acres; Stonington, 73 acres; and Waterford, 64 acres.

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In conclusion, we can note that waterside property is desirable for many land uses. Industries often favor sites on rivers in order to obtain water for cooling or washing, to dispose of waste material, or for the convenience of water transportation. Waterside property is necessary for commercial establishments such as marinas or certain specialized restaurants. Residential property accessible to the water is at a premium. Finally, public recreation areas are much more popular if they incorporate land fronting on a stream or lake.

COASTAL FEATURES

As a result of glaciation and coastal submergence, the coastal features of the region are irregular and marked by many inlets, coves, promontories, and tidal marshes. The most prominent feature is, of course, the Thames River Estuary.

The irregular coast line and river shores of Southeastern Connecticut are noted for their scenic beauty, and much thought should be given to their potential for recreational and conservation use.

Seashore bathing beaches available for use by the general public are presently quite limited in Southeastern Connecticut. There are numerous private beaches and a few town beaches, but only two beaches along the entire coast line of the region are presently available for use by the general public. These are located at Rocky Neck State Park in East Lyme, and at Ocean Beach Park in New London. 6/ Together they provide a total of less than 5,000 feet of beach frontage on Long Island Sound. This represents slightly less than 1.5% of the entire sixty-four miles of coast line in the region. 7/ The two parks contain a total of about 19 acres of beach.

It now appears that there will be a long-term need for additional beaches open to the general public in this region. This question will be examined in detail in the

6/ The bathing beach at Harkness Memorial State Park in Waterford is restricted to use by handicapped persons.

7/ This coast line measurement includes the shore south of the New Haven Railroad tracks between Pawcatuck Point on the Pawcatuck River to Eastern Point on the Thames River and from the New London Light House to the Four Mile River.

regional recreation and open space study scheduled for a later phase of the agency's program.

An additional State Park is currently planned at Bluff Point which would provide an additional 4,000 feet of bathing beach. An outstanding example of local action to provide recreation areas for the future is the purchase of a 95-acre Beach Park by the Town of Waterford. Other potential beach sites still exist along the coast, but the spread of urban and suburban development could rapidly change this picture. Unfortunately, this change is accompanied by an increased need for more varied recreational facilities as the population of the region grows and as its residents obtain increased amounts of leisure time.

The most significant physical problem connected with the river shores and coastal areas of the region is the threat of hurricane damage. The entire coast line and the land adjacent to the rivers and estuaries as far north as Norwich have experienced damage from hurricane flooding.

Studies of hurricane tidal flooding in this area have been made over a period of years by the U.S. Army Corps of Engineers. 8/ Their investigations reveal that the highest recorded tidal flood levels occurred during the hurricane of September, 1938, when the water reached a height of 9.7 feet above mean sea level. In August, 1954, Hurricane Carol produced tidal floods reaching 8.9 feet above mean sea level. The damages and water levels of each of these storms would have been greater had the hurricanes hit during the periods of normal high tides.

To determine the potential effects of hurricane tidal flooding on the Southeastern Connecticut coast line, it was calculated that a severe storm on a critical track, coinciding with a high tide, could produce flooding to about 14 feet above mean sea level, or about 13 feet above mean high water. Higher flood levels would occur in some areas from wave action, fresh water accumulation, and back-up in coves and estuaries.

Three hurricane protection projects designed to meet the severest conditions anticipated have already been authorized in Southeastern Connecticut. These include dike and

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8/ U.S. Government Printing Office. House Document No. 212, 86th Congress, First Session, 1959; and House Document Nos. 411 and 478, 87th Congress, Second Session, 1962.

barrier protection at Pawcatuck, Mystic, and New London. Other projects are under consideration at Montville, Thamesville, and at the mouth of the Thames River.

A comprehensive report on hurricane flooding in Eastern Connecticut, prepared by the Corps of Engineers, is scheduled for completion and publication later this year.

In addition to their studies regarding the effects of hurricanes, the Corps of Engineers has conducted Beach Erosion Control Studies for the entire Southeastern Connecticut coast line. 9/ These studies point out that the natural processes of beach replenishment have been disrupted throughout the area. Headlands, which formerly supplied material for beach replenishment, have generally been eroded to bedrock or otherwise protected by sea walls or revetments. Consequently, the slow but steady deterioration of beaches can be prevented only by the artificial transfer of sand from on- or off-shore deposits to the beaches. In some areas the construction of groins assists in holding the filling in place, but groins alone are not sufficient to build up new beaches.

Improvement plans were devised for the following areas along the coast.

1. Esker Point, Groton
2. Bushy Point, Groton
3. Jupiter Point, Groton
4. Eastern Point Beach Park, Groton
5. Neptune Park & Ocean Beach Park, New London
6. Goshen Cove Inlet, Waterford
7. Giants Neck, East Lyme

The only area that the Corps of Engineers recommended for improvement was the Eastern Point Beach Park in Groton. This project has not been carried out. At present the State Water Resources Commission is preparing detailed designs for an improvement at Neptune Park, and the Town of Groton has expressed interest in an improvement at Esker Point.

9/ U.S. Government Printing Office. House Documents Nos. 31 and 84, 83rd Congress, First Session, 1953; and House Document No. 334, 85th Congress, Second Session, 1958.

barrier protection at Pawcatuck, Mystic, and New London. Other projects are under consideration at Montville, Thamesville, and at the mouth of the Thames River.

A comprehensive report on hurricane flooding in Eastern Connecticut, prepared by the Corps of Engineers, is scheduled for completion and publication later this year.

In addition to their studies regarding the effects of hurricanes, the Corps of Engineers has conducted Beach Erosion Control Studies for the entire Southeastern Connecticut coast line. 9/ These studies point out that the natural processes of beach replenishment have been disrupted throughout the area. Headlands, which formerly supplied material for beach replenishment, have generally been eroded to bedrock or otherwise protected by sea walls or revetments. Consequently, the slow but steady deterioration of beaches can be prevented only by the artificial transfer of sand from on- or off-shore deposits to the beaches. In some areas the construction of groins assists in holding the filling in place, but groins alone are not sufficient to build up new beaches.

Improvement plans were devised for the following areas along the coast.

1. Esker Point, Groton
2. Bushy Point, Groton
3. Jupiter Point, Groton
4. Eastern Point Beach Park, Groton
5. Neptune Park & Ocean Beach Park, New London
6. Goshen Cove Inlet, Waterford
7. Giants Neck, East Lyme

The only area that the Corps of Engineers recommended for improvement was the Eastern Point Beach Park in Groton. This project has not been carried out. At present the State Water Resources Commission is preparing detailed designs for an improvement at Neptune Park, and the Town of Groton has expressed interest in an improvement at Esker Point.

9/ U.S. Government Printing Office. House Documents Nos. 31 and 84, 83rd Congress, First Session, 1953; and House Document No. 334, 85th Congress, Second Session, 1958.

A complete review of beach erosion control is not within the scope of this report. But the Regional Planning Agency maintains a file of information on this subject received from the Corps of Engineers, and this is always available to municipal officials and others interested in this subject.

SUMMARY OF MAJOR FINDINGS

TOPOGRAPHY

1. The present pattern of development shows a strong relationship to the topographic structure of the region. Most development has occurred in the coastal lowland and in stream valleys.

2. Nearly 30%, or 150 square miles, of the region has a slope of more than 10%. Although such slopes present difficulties to intensive development, the steep hillsides could be used as parks and greenbelts within and around areas of development.

3. Only 4.9% of the region's present development lies on slopes greater than 10%.

4. The irregular topography of the region is a major scenic asset.

DRAINAGE PATTERN

1. Water bodies are becoming increasingly important as recreation areas and sources of drinking and industrial water.

2. Pollution is a continuing problem along many streams. A region-wide study of this is needed.

3. Flooding may be a potential problem as development expands into the upper portions of the region's watersheds. Small Watershed Projects, flood plain zoning, and local open space programs are tools with which to meet this possibility.

COASTAL FEATURES

1. With a coast line of 64 miles, the region has less than 5,000 feet of beach frontage open to the general public. There will be a growing need for additional public beach.

2. Beach erosion studies show that the natural replenishment of beaches along our coast has ceased. The Army Corps of Engineers finds that the steady deterioration of our beaches can be prevented only by artificial transfer of sand from on- or off-shore deposits to the beaches.

III. GENERAL POTENTIAL OF UNDEVELOPED LAND

DEFINITIONS AND METHODS

CLASS A UNDEVELOPED LAND

Amount and Distribution

Potential Developed Use

Potential Open Space Use

CLASS B UNDEVELOPED LAND

Amount and Distribution

Potential Developed Use

Potential Open Space Use

SUMMARY OF MAJOR FINDINGS

The distribution and quantity of future land uses will be greatly influenced by the physical capabilities of presently undeveloped land. We have already seen that the physical condition of the land surface in Southeastern Connecticut is highly irregular. In this section we will take a closer look at the land surface and evaluate the broad physical potential of the undeveloped land in the region.

DEFINITIONS AND METHODS

Before proceeding, we should have a clear understanding of what is meant by the term "undeveloped land." Land use data for the region have been collected and analyzed according to three major categories: 10/

(1) Developed Land, consisting of residential, commercial and industrial, institutional and governmental, and utilities and transportation uses. In addition, for the purposes of this study, it also includes 2.9 square miles of vacant land in small parcels scattered within the highly urbanized areas.

(2) Public Open Space, comprising state preserves, water reservoir sites, and intensive recreational facilities such as parks, golf courses, camps, etc.

(3) Undeveloped Land, which includes all land not classified as Developed Land or Public Open Space. It consists of all agricultural land, privately-owned woodland, swamps, and any other vacant land. (See Figure 5 on page 22)

Developed land accounts for only 46 square miles of the region's 511-square-mile land area. In addition, Open Space uses presently occupy 48 square miles of the region. Fully 81.4% of the region lies in an undeveloped state at the present time. This amounts to 417 square miles of undeveloped land. Because of soil and slope variations, the undeveloped land contains a wide variety of physical characteristics. In the following pages we will discuss this undeveloped land on the basis of its broad physical capabilities.

10/ See: Land Use: Patterns and Policies published by SCRPA in December, 1962.

SOUTHEASTERN CONNECTICUT REGION

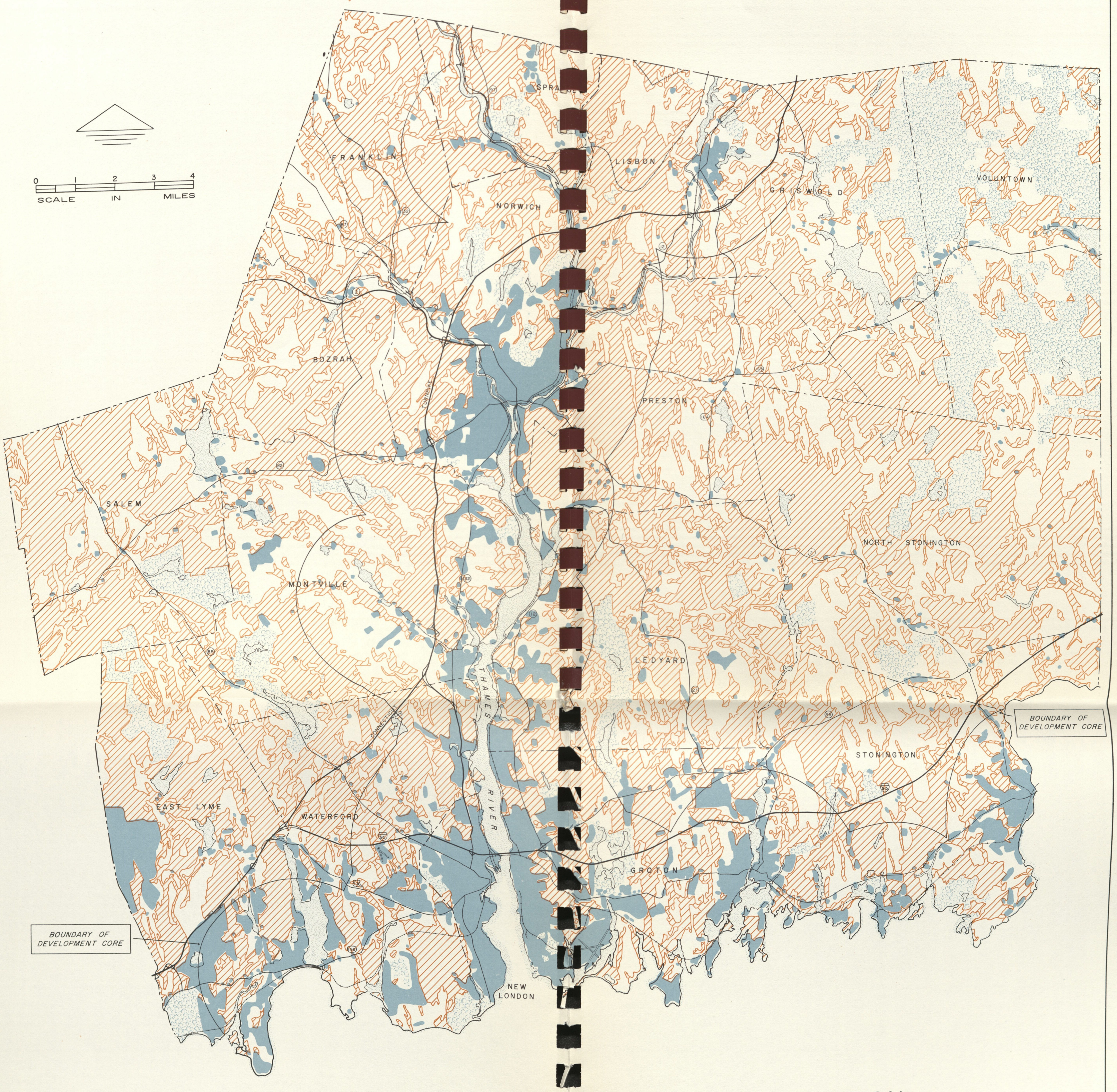

FIGURE 5

GENERAL LAND INVENTORY & EVALUATION

LEGEND

- CLASS A UNDEVELOPED LAND (WELL DRAINED SOILS, WITH SLOPES LESS THAN 10%)
- CLASS B UNDEVELOPED LAND (SHALLOW TO BEDROCK SOILS, POORLY DRAINED SOILS, OR SLOPES IN EXCESS OF 10%)
- DEVELOPED LAND
- RECREATION & OPEN SPACE LAND
- WATER

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For the purpose of this discussion, we have classified the undeveloped land into two general categories: Class A and Class B. The basis of this classification is the character of the soil and the slope of the land surface.

Land which generally presents no major limitations for intensive development is termed Class A Undeveloped Land. This land ranges from nearly level to gently sloping or undulating up to a maximum of 10% slope. (A 10% slope is one which rises 1 foot in elevation in 10 linear feet.) There is a broad range of stoniness in the Class A land, but bedrock is at a sufficient depth to present no major problem to development. Drainage is not a difficult problem but must be given consideration on individual sites because of seasonal high water tables on the moderately well drained soils and small inclusions of even wetter soils. 11/

Class B Undeveloped Land has certain physical limitations for more intensive development. Included in this category is land with a slope generally in excess of 10%, shallow to bedrock soils, areas with a slowly permeable, hardpan layer to a depth of from 2 to 3 feet, areas of poorly drained mineral soils or swamps and bogs, tidal marshes, and coastal beaches and dune sands.

CLASS A UNDEVELOPED LAND

AMOUNT AND DISTRIBUTION

Southeastern Connecticut has a tremendous potential for growth. Out of a total of 417 square miles of undeveloped land in Southeastern Connecticut, 163 square miles are rated Class A. (See Figure 6 on page 24)

This land is distributed unevenly throughout the entire region. New London, being more highly developed than any other town in the region, has only 7.4% of its total land area in the Class A category. Complex topography and large amounts of state preserves have left only 20% of East Lyme and 23% of Voluntown in this category. Class A land accounts

11/ More detailed information on the drainage characteristics of the Class A land can be gained from an inspection of the General Soil Maps produced by the Soil Conservation Service of the Department of Agriculture. These maps are available at the office of the Regional Planning Agency.

MAJOR LAND USES AND TYPES

SOUTHEASTERN CONNECTICUT REGION, 1963

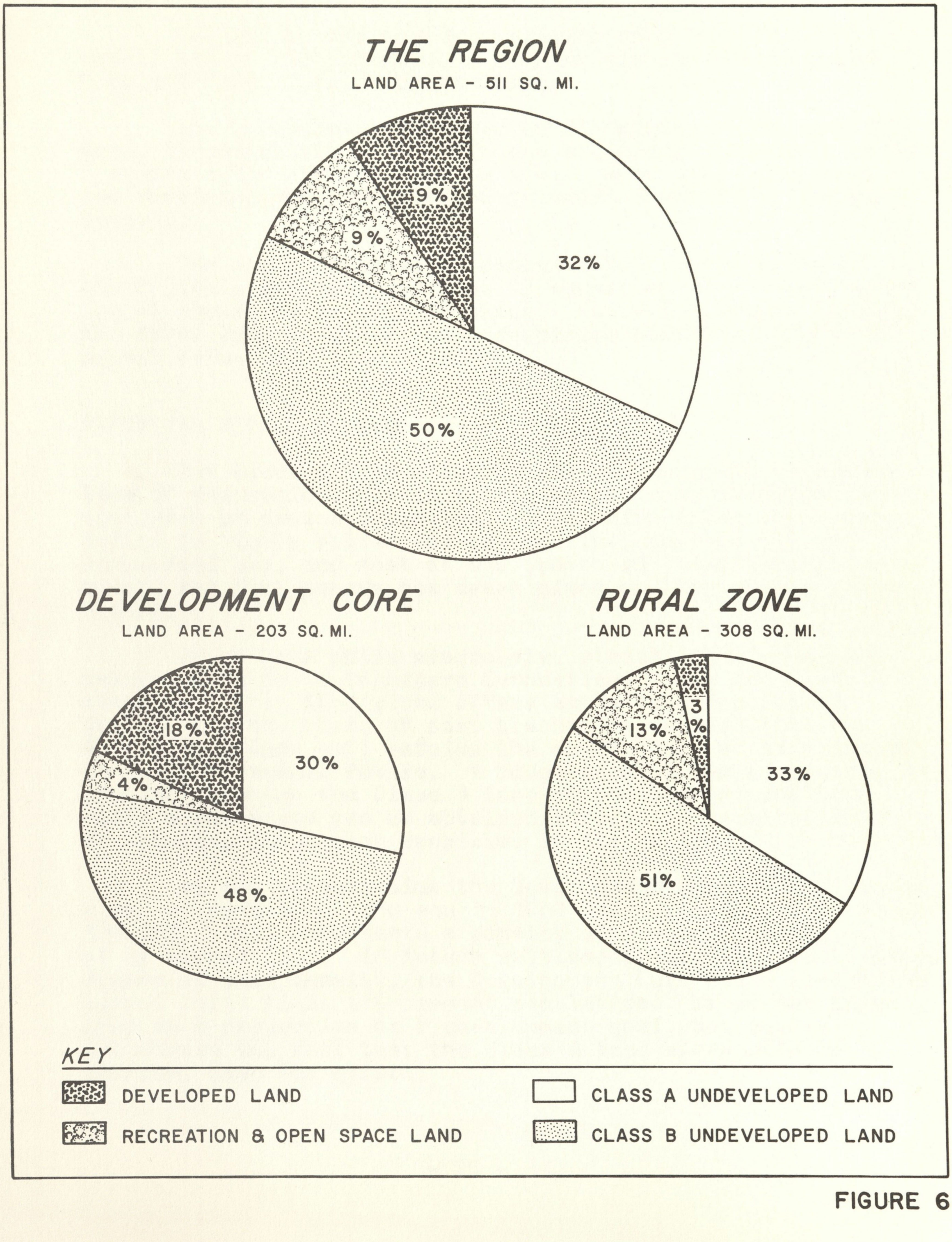


FIGURE 6

for 25 to 40% of the land area in each of the 14 other towns of the region. Within each town, the distribution of Class A land is highly fragmented because of the irregular land surface of the region.

Turning to the broader regional level, we find that nearly 40% of all undeveloped land in both the Development Core and Rural Zone is rated Class A.

The Development Core covers 203 square miles of land area, 36 square miles of which are developed. An additional 8 square miles are occupied by public open space uses. Of the remaining 159 square miles of undeveloped land, 62 are Class A.

The Rural Zone, which contains 308 square miles of the region's land surface, has 10 square miles of development and 40 square miles of open space. Fully 258 square miles of the Rural Zone remain in an undeveloped state, of which 101 square miles are Class A land.

POTENTIAL DEVELOPED USE

The Class A land might be called the prime buildable land of the region. It is fairly level, with little or no stoniness or drainage problems. Land with these characteristics is highly suited for residential, commercial, and industrial use, and most of the growth in these activities during the past decade has taken place on land of the Class A type.

As we have noted previously, almost 40% of the undeveloped land in Southeastern Connecticut is in the Class A category. This land alone offers ample room for future growth. On the basis of past trends, it appears that the Development Core will receive the major share of this growth in the foreseeable future. A rough idea of the additional population which the Class A land of the Development Core could accommodate can be obtained through an examination of existing population densities in the region.

At the present time the Development Core has 36 square miles of developed land and in 1960 had a population of about 158,000. This represents a density of 6.9 persons per acre of developed land. If future settlement were limited to Class A land at this density, the Development Core could accommodate almost three times its present population. We do not offer this as a projection or a development goal, but rather to illustrate the fact that the Class A land alone affords abundant room for growth.

The Rural Zone, with its greater amount of Class A land, has even more room for growth. The growth which has occurred in the Rural Zone in recent years has been located almost entirely on what would have been classified as Class A land. However, the pressures for development are not nearly as great in the Rural Zone as they are in the Development Core. Lower land costs and a lack of stringent zoning and subdivision regulations are the probable causes for whatever subdivision activity has taken place in the Rural Zone in recent years.

It does not appear likely that the amount of growth in the Rural Zone will approach that of the Development Core in the foreseeable future. New land control regulations and steadily rising land costs in the Rural Zone will only act to put this area on a more equal basis with the Development Core insofar as its attractiveness for development is concerned. Under such conditions, the existing forces - ease of access to employment, shopping, and service areas - which attract new growth to the Development Core will continue to outweigh those of the Rural Zone.

The fragmented distribution of Class A land throughout most of the region suggests that the "cluster" approach in development might be an appropriate type of residential settlement in some parts of the region. Under the cluster approach, the overall population density permitted in a proposed subdivision is established by the zoning ordinance. But instead of requiring the permitted population to be distributed evenly within the subdivision, homes are "clustered" on smaller lots and a substantial portion of the subdivision is left in one piece as permanent open space. Through this practice, the overall population density required by the zoning regulations is maintained while greater flexibility in subdivision design becomes possible.

Application of the cluster principle here in Southeastern Connecticut would appear to offer one means of efficiently utilizing the scattered Class A land. Small, isolated parcels of Class A land could be used as sites for clustering homes, and surrounding areas of Class B land could be used to fulfill open space requirements and maintain the desired overall population density. Possible implementation of the cluster concept will be examined in detail in later phases of the regional plan preparation.

POTENTIAL OPEN SPACE USE

The fact that the Class A land is physically quite suited for building does not imply that it should be used

entirely for development purposes. On the contrary, other equally necessary land uses require level, well-drained land. For example, agriculture is one of our most important users of Class A land and will continue to be so in the future. Although much of our open space needs can be realized through the utilization of Class B land, some Class A land will be needed for this important use as well.

Active recreation areas, such as playgrounds and athletic fields, require level, well drained sites in fairly close proximity to areas of development. For example, playground areas are desirable or may be required within subdivisions. In such cases, the use of Class A land may best meet the need for an active recreation facility.

CLASS B UNDEVELOPED LAND

AMOUNT AND DISTRIBUTION

Of the total amount of undeveloped land in the region, 254 square miles, or almost half of the region, is Class B land. This land presents some physical obstacles to more intensive development. Like the Class A land, the Class B land is scattered throughout the entire region and comprises a sizeable portion of every town. In fact, more than half of the undeveloped land in each town is in this category.

The Development Core has 97 square miles of the Class B land, while the remaining 157 square miles of land in this category are located in the Rural Zone.

POTENTIAL DEVELOPED USE

In spite of the physical difficulties it presents, it is obvious that some of the Class B land will be built upon. Areas with the characteristics of Class B land have already been built on in some of the older urban settlements, and some suburban development has also been located on this type land. But in recent years, most development has been located on land physically suitable for building. There has, for example, been very little subdivision on slopes in excess of 10% since 1951.

The probability of urban development occurring on Class B land is much greater in the Development Core than in the Rural Zone. In the years between 1951 and 1962 the Development Core absorbed 75% of all new development in the region. As growth within the Core continues, the pressures of development will extend in many areas to the Class B lands.

Development on some of the Class B land appears possible under two conditions:

(1) on scattered lots of at least an acre and
(2) on smaller lots where public water supply and sewerage systems are provided.

This would suggest that those towns which do not require or furnish public water or sewerage systems can expect a more scattered type of development - that is, development which conforms more closely to the physical capabilities of the land itself. Where public water and sewerage facilities are available, there is a better chance of achieving a cohesive community development, utilizing both the Class A and the Class B land.

POTENTIAL OPEN SPACE USE

Although the Class B land presents problems for intensive development, it is in many ways highly suited for open space and recreation purposes. Steep slopes, stony soil, ledge, and poor drainage are not major obstacles to such uses as parks, reservoirs, forest preserves, and wildlife conservation areas.

In fact, the very characteristics which make the Class B land less suitable for intensive development can be assets for open space and recreation uses. Broken topography, with areas of steep slope, ledge, and swamp, provides a much more attractive and varied park setting than does uniformly level land. Wetlands, both interior and coastal, are ideally suited to wildlife conservation.

As a general rule, it seems desirable to exploit the natural advantages of the Class B land as a setting for many of the region's future open space and recreation facilities, particularly for those facilities requiring a large land area.

SUMMARY OF MAJOR FINDINGS

1. 81.4% of the region is presently undeveloped.

2. Of the 417 square miles of undeveloped land, 163 square miles are well drained and have a slope of less than 10%. This area is called the Class A Undeveloped Land.

3. Poorly drained soils, shallow to bedrock soils, or steeply sloping undeveloped land is termed Class B Undeveloped Land. The region has 254 square miles of land in this category.

4. The Development Core, which contains 77% of the region's development, has 62 square miles of Class A land and 97 square miles of Class B land. The pressure of development will continue to be most strongly felt in the Development Core.

5. The Rural Zone has 101 square miles of Class A and 157 square miles of Class B land.

6. The distribution of Class A land is fragmented and scattered.

7. Class A land is physically the most suitable land for intensive development in the future.

8. "Cluster" development appears to offer a means of efficiently utilizing the scattered Class A land.

9. Intensive development of Class B land should require public water and sewerage systems or be limited to scattered large lots.

10. The physical characteristics of the Class B land make it ideally suited for conservation and open space uses.

IV. SPECIALIZED POTENTIAL OF UNDEVELOPED LAND

PRIME AGRICULTURAL LAND

POTENTIAL RESERVOIR SITES

TIDAL MARSHES AND ESTUARIES

INTERIOR WETLANDS

SIGNIFICANT GEOLOGIC FEATURES

SUMMARY OF MAJOR FINDINGS

Urban and suburban activities, although influenced by the character of the land's surface, are not entirely dependent on it. But there are a number of activities for which the nature of the land is of overriding importance. Agriculture, water supply, and wildlife conservation are each strongly tied to the character of the land. Because of this, it is important that we be aware of the areas in the region with a high physical potential for activities of this type. In this chapter we will present the views and findings of a number of experts on specialized land types within Southeastern Connecticut.

PRIME AGRICULTURAL LAND 12/

Agriculture in Connecticut is a declining user of land. Farming reached its peak in this state about 1860, when as much as 1.9 million acres are estimated to have been actively farmed. 13/ By 1955 the amount of cropland and pasture had dropped to less than 600,000 acres, or roughly a third of what it was a century earlier. 14/ Farmland is expected to drop even further in the future, and by 1975 cropland and pasture will probably occupy only 460,000 acres of land in Connecticut. 15/

Initially, the decline in the amount of land in Connecticut used for agriculture was the result of competition from the more fertile agricultural areas of the Midwest. Competition has continued to be a factor in eliminating marginal operations, but it has also been joined by rising productivity and by direct and indirect pressures of

12/ For assistance in this section we are indebted to Robert Laramy, David Thompson, and Arthur Shearin of the Soil Conservation Service; Stanley Hale, New London County Agent; and Joseph Hickey, Jr. of the Connecticut Development Commission.

13/ Connecticut Development Commission. The Use of Land. Technical Report 121. Hartford, Conn., 1962, p. 5.

14/ Connecticut Conservation Needs Committee. Connecticut Soil and Water Conservation Needs Inventory. Storrs, Conn., The University of Connecticut, College of Agriculture, 1962, p. 15.

15/ Loc. Cit.

urbanization. The direct conversion of farm land to urban and suburban development can be seen on almost any country road. Less obvious is the indirect pressure of rising taxes as once rural communities are suburbanized. 16/

The effect of competition, increasing productivity, and urbanization has been to drive out the less productive marginal farm operators. In the struggle for survival, the character of the land always has been of prime consideration. Often it was a decisive factor. It has been said that " . . . the remaining agricultural lands represent generally the best farm soils in Connecticut. As the result of over 300 years of experimental agronomy, and a long period of decline in lands devoted to agricultural activity, the marginal lands have been allowed to return to forest." 17/

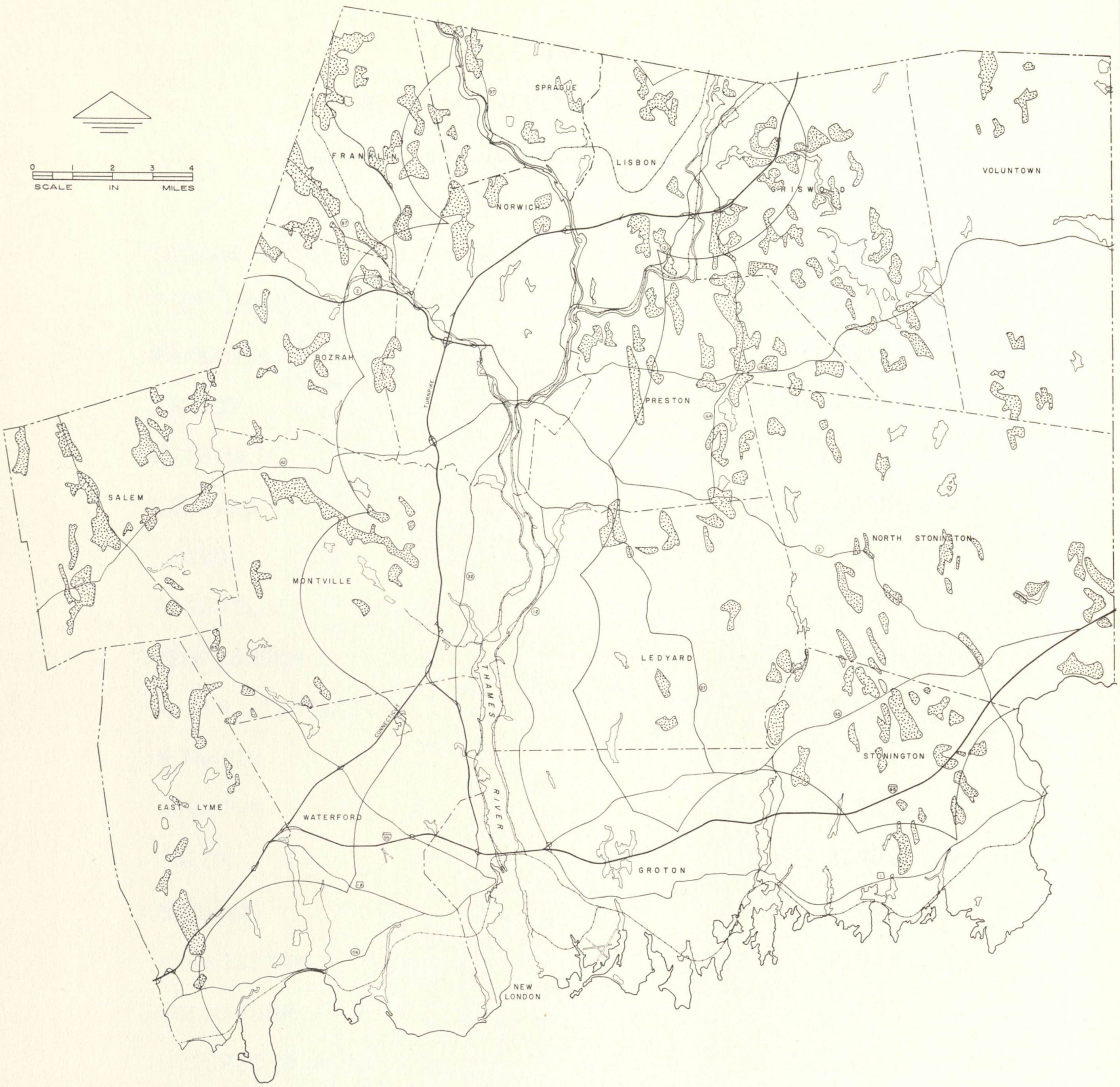
What has been true in the past is likely to be of some truth in the future. The farms on better agricultural soils will have a better chance for survival than farms on poorer soils. In addition, larger farms have better prospects than very small farms. And farms at some distance from the area of most active urban development will be more likely to continue in operation that farms close to development.

With the assistance of the Soil Conservation Service and the New London County Agent, the Prime Agricultural Land in Southeastern Connecticut has been identified. Prime Agricultural Land consists of existing large concentrations of cropland and pasture outside the immediate path of development, located on soils considered to be best suited to agriculture, and with a slope generally below 15%. It should be emphasized that the Prime Agricultural Land does not include all present agricultural areas, nor does it include all soils suited to agriculture. It does depict those areas currently believed to offer the best prospects for continued agricultural use.

16/ This session of the Connecticut Legislature adopted a bill which will permit agricultural land, and some open space land, to be classified and taxed according to its agricultural or open space value.

17/ The Use of Land, op. cit., p. 8.

SOUTHEASTERN CONNECTICUT REGION



PRIME AGRICULTURAL LAND

SOURCE: SOIL CONSERVATION SERVICE
& COUNTY AGRICULTURAL AGENT

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FIGURE 7

PREPARED BY THE SCRPA STAFF – 1963

TABLE ONE

PRIME AGRICULTURAL LAND *

Southeastern Connecticut Region

	ACRES
BOZRAH	918
EAST LYME	1,166
FRANKLIN	2,313
GROTON	---
GRISWOLD	2,616
LEDYARD	890
LISBON	670
MONTVILLE	1,451
NEW LONDON	---
NORTH STONINGTON	2,102
NORWICH	744
PRESTON	2,561
SALEM	2,102
SPRAGUE	606
STONINGTON	2,084
VOLUNTOWN	662
WATERFORD	---
REGIONAL TOTAL:	20,885

SOURCE: Survey by Soil Conservation Service and County Agricultural Agent.

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* See page 32 for definition of Prime Agricultural Land.

grow. Whether an attempt to maintain agriculture as a major land use in Southeastern Connecticut is economically sound or locally acceptable will be the subject of future studies.

POTENTIAL RESERVOIR SITES

The question of a water supply to meet the immediate and long-term needs of Southeastern Connecticut has been the subject of considerable discussion and study during the past two years. In 1961 the Governor appointed the Eastern Connecticut Industrial Fresh Water Development Commission to study the long-term water needs of this region and to evaluate possible sources of supply. A comprehensive technical study covering these points was completed in April, 1962. 19/

The Metcalf & Eddy study found that if all of Southeastern Connecticut's 1960 population of 174,412 were served by public water systems, an average of 27 million gallons per day (mgd) would be required. By 2010 it is estimated that a regional population of 380,000 would require from 75 to 114 mgd. To fill this future need, the engineers found that there are 46 sites on streams, other than the Thames, Shetucket, and Quinebaug Rivers, that are physically capable of development into reservoirs and that would have individual dependable yields of from 1 to 71 mgd. If all 46 potential reservoir sites were developed, a total yield of 250 mgd could be anticipated.

In view of the fact that the combined possible yield of all 46 potential reservoirs is far in excess of anticipated water needs by 2010, it is obvious that not all potential sites will be needed within that period. Some selection among potential sites is possible.

To provide a basis on which to judge the merits of alternate sites, SCRPA's staff delineated on topographic maps the area at each potential reservoir that would be flooded if a reservoir were constructed with the water surface elevation indicated as physically feasible in the

19/ Metcalf & Eddy. Report to Eastern Connecticut Industrial Fresh Water Development Commission Upon Surface Water Supplies Available in Southeastern Connecticut. Boston, April, 1962.

Metcalf & Eddy study. Each potential reservoir was then evaluated as to the following:

(1) The effects the reservoir would have on presently existing land use, highways, and railroads.

(2) The present amount and type of development around the site and the effect this would probably have on the reservoir.

(3) The alternate uses to which the potential reservoir site could be put.

Potential sites were not considered desirable, even though they may be physically feasible for development as reservoirs, if they:

(1) Produced a major dislocation of the present transportation system or developed land use.

(2) Were likely to experience a pollution problem because of existing development.

(3) Had a particularly high potential for active recreational use.

This analysis indicated that 21 of the 46 sites considered to be physically capable of development into reservoirs were undesirable for some non-physical reason. According to the calculations of Metcalf & Eddy, the remaining 25 potential reservoirs have an estimated dependable yield of 115.4 mgd. (See Table 2 on page 38.) Present and planned reservoirs owned by existing utilities have a dependable yield of 27.6 mgd. These plus the development of the 25 highest potential reservoirs could produce a total dependable yield of 143.0 mgd, 29.0 mgd above the highest estimated water need in 2010.

The 25 potential reservoir sites judged to have the highest rating are shown on Figure 8 on page 39, along with existing and planned reservoirs. It is quite clear from this map that water supply will increasingly be an intermunicipal concern in the future. Population in the Development Core of the region will be dependent for water upon reservoirs located in the more rural towns.

A key feature of future land use planning should be to preserve the highest potential reservoir sites for water supply use. The most comprehensive approach to implementing

TABLE TWO

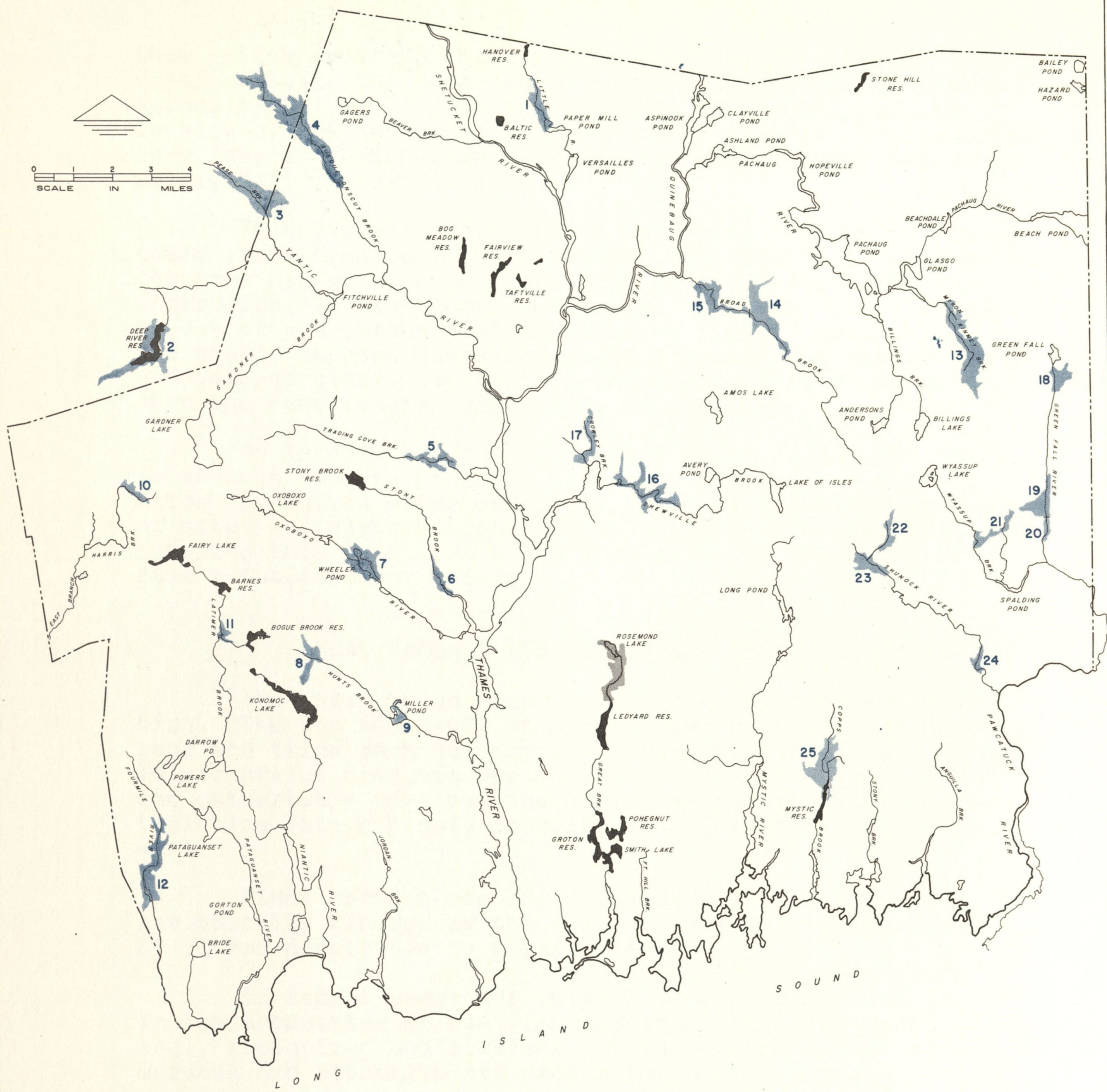
HIGHLY RATED POTENTIAL RESERVOIR SITES

Southeastern Connecticut Region

Site No.	Watercourse	Estimated Dependable Yield, mgd
1	Little River	9.5
2	Deep River	5.8
3	Pease Brook	7.7
4	Susquetonscut Brook	9.6
5	Trading Cove Brook	8.8
6	Stony Brook	2.6
7	Oxoboxo Brook	5.1
8	Hunts Brook	2.2
9	Millers Pond	3.3
10	Harris Brook	1.3
11	Latimer Brook	1.1
12	Four Mile River	4.1
13	Myron Kenney Brook	4.5
14	Broad Brook	10.2
15	Broad Brook	8.3
16	Shewville Brook	5.2
17	Crowley Brook	1.5
18	Green Fall River	2.7
19	Green Fall River	5.0
20	Green Fall River	2.2
21	Wyassup Brook	2.2
22	Yawbucs Brook	1.7
23	Shunock River	3.3
24	Shunock River	2.4
25	Copps Brook	5.1
TOTAL:		115.4

Source: Metcalf & Eddy Study.

SOUTHEASTERN CONNECTICUT REGION



RESERVOIR SITES

LEGEND

- EXISTING RESERVOIRS
- PLANNED RESERVOIRS
- HIGHLY RATED POTENTIAL RESERVOIR SITES

(SEE TABLE TWO FOR INFORMATION ON POTENTIAL RESERVOIR SITES.)

FIGURE 8

701 PROJECT: CONN. P-30(G)

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this policy would be through a regional water authority. Unfortunately, the proposed Southeastern Connecticut Water Authority failed to pass this session of the Legislature. In view of the intermunicipal aspects of future water supply, some form of region-wide management of water resources ultimately will be essential.

Techniques for preserving potential reservoir sites could range from outright purchase, with possible lease back for some use not incompatible with their ultimate use as reservoirs, to less costly measures. Purchase of an option to buy or the purchase of development rights would not be too costly in most cases and would maintain the site in an undeveloped state. In certain instances, zoning for watershed and conservation use may be feasible.

An important point to be kept sight of is that there is as much need to preserve presently available reservoir sites for future water supply as there is to develop additional sites and distribution systems to serve present needs. By ignoring this point, we could meet existing needs and still face a future water crisis.

TIDAL MARSHES AND ESTUARIES 20/

The coast is an area of physical conflict and transition. The sea endlessly hammers at the exposed edge of the land and twice each day surges up coastal streams and rivers. This conflict produces two physical features - tidal marshes and estuaries - that combine marine and continental characteristics into a highly productive, highly fragile environment.

Tidal marshes are low-lying deposits of alluvium periodically flooded by the sea. Estuaries are the portions of rivers penetrated by normal tides.

In recent years the role of tidal marshes and estuaries in the production of fin fish and shell fish has been increasingly recognized and studied. It is now known that tidal marshes and estuaries are "among the most naturally fertile

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20/ For assistance in this section we are indebted to Dr. John Rankin of the University of Connecticut and James Bishop of the State Board of Fisheries and Game.

areas of the world." 21/ As such, they are of considerable importance as a food source for marine life.'

Estuaries also play an important role as a spawning ground for many fish, both commercial and sport varieties, and as a kind of marine nursery for the larvae and juvenile fish of some species. A study of the Mystic River Estuary over a period of 20 months produced a collection of 59 different species of fish. This included eggs from 13 species, the larvae of 26 species, and juveniles and adults of 51 species. 22/

Beyond their biological function, the tidal marshes and estuaries are of potential value from several other standpoints. Marshes are useful in reducing the intensity of storm waves, and they can be scenic elements in an open space system. Estuaries have an obvious scenic and recreational potential.

Connecticut contains close to 15,300 acres of tidal marsh at the present time and the Southeastern Region has a total of just under 1,100 acres. 23/ The quantity of marsh in this region is small when measured against the region's total land area of more than 328,000 acres.

The marshes of Southeastern Connecticut are quite fragmented. Twenty-three separate marsh areas have been identified and are shown on Figure 9 on page 42. In size the marshes range from a low of 3 acres to a high of 239 acres, but 14 of them contain 20 acres or more. Table 3 provides more detailed information on size and ownership.

The use to which a marsh is put is very often determined by its ownership. Marshes owned by private conservation groups or by state wildlife agencies are likely to remain in

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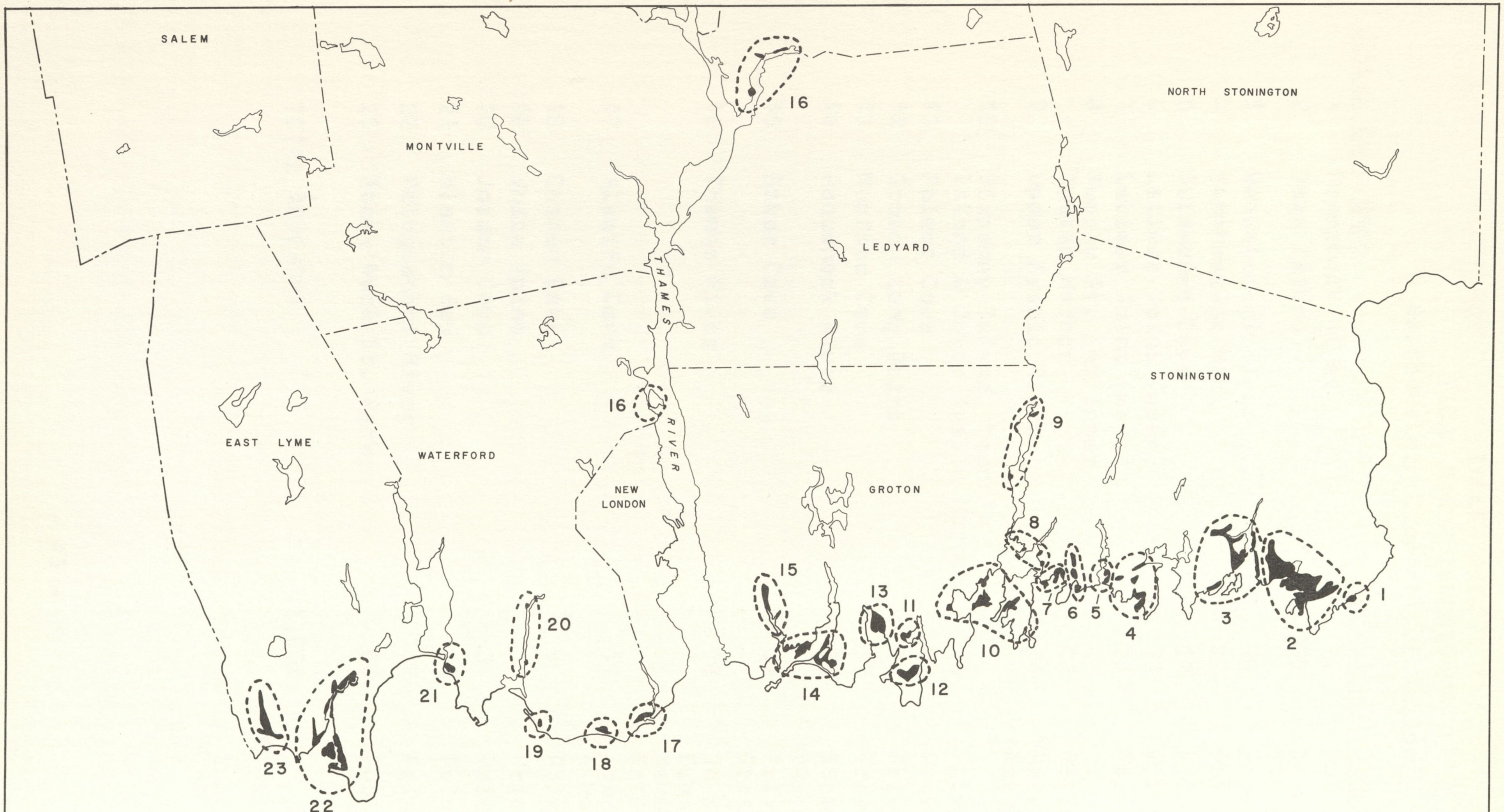
21/ Eugene P. Odum. The Role of Tidal Marshes in Estuarine Production. Contribution No. 29, University of Georgia Marine Institute, 1961.

22/ Pearcy, William G. and Richards, Sarah W. "Distribution and Ecology of Fishes on the Mystic River Estuary, Connecticut." Ecology, Volume 43, No. 2, 1962, pp. 248-259.

23/ Nature Conservancy. The Tidal Marshes of Connecticut, A Preliminary Inventory. 1962; and survey by SCRPA.



TIDAL MARSHES

SOUTHEASTERN CONNECTICUT REGION

SEE TABLE THREE FOR A DESCRIPTION OF SITES

FIGURE 9

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TABLE THREE

TIDAL MARSH INVENTORY

Southeastern Connecticut Region

Marsh No.	Name	Acreage	Ownership
1	Pawcatuck River	12	Private
2	Barn Island	239	46 ac. private 193 ac. Fish & Game
3	Wequetequock River	99	Private
4	Wamphassuck Neck	39	Private
5	Quiambaug Cove	22	Private
6	Latimer Point (east)	21	Private
7	Latimer Point (west)	26	Private
8	Murphy Pt. and Inner Mystic Harbor	12	Private
9	Upper Mystic River	24	Private, State, Nature Conservancy
10	Sixpenny Island, Mason's Island & Outer Mystic Harbor	93	Private
11	Palmer Cove	10	Private
12	Groton Long Point	27	Private
13	Mumford Cove	37	Private
14	Poquonock River	65	35 ac. Bluff Pt., 30 ac. Trumbull Airport
15	Baker Cove	37	Private & Town of Groton
16	Thames River	18	14 ac. Poquetanuck Cove; Private; 4 ac. Mamacoke Is., Conn. College
17	Alewife Cove	17	Waterford Beach Park & Harkness St. Park
18	Goshen Cove	9	Private
19	White Point	3	Private
20	Jordan Cove	3	Private
21	Niantic Bay	18	Private
22	Pataguanset River	168	Private & Public
23	Rocky Neck St. Park	69	Public
TOTAL ACREAGE:		1,068	

an open state. Privately-owned marshes may remain open or may be filled or dredged for some special purpose.

There is a wide diversity in the ownership of marshes in Southeastern Connecticut. Together, the State Park and Forest Commission and the Board of Fisheries and Game own slightly more than 300 acres of marsh. Another 11 acres are controlled by private groups concerned with conservation, and 13 acres are included in the Waterford Beach Park. The remaining 743 acres are privately-owned or controlled by public agencies not concerned with conservation. The largest privately-owned complex of tidal marsh is that along the Pataguanset River in East Lyme. There are 168 acres of marsh in this area.

The future of the privately-owned marshes, comprising 66% of all marsh land in the region, is uncertain. There are many who favor the preservation of all tidal marsh in as natural a state as possible. There are at least as many who favor its development to some more "productive" use. The most reasonable course probably lies somewhere between these extremes.

Marsh land is the smallest, and one of the most unique, land types in Southeastern Connecticut. The region's marshes are also among the least disturbed by man of those remaining in Connecticut. 24/ On these grounds alone, the marshes deserve priority in an open space program.

Among the marsh land areas, highest priority for preservation as open space should be given to the larger complexes. The four largest privately-owned marsh areas contain nearly 60% of the total in this category. These are: the Pataguanset River, 168 acres; the Wequetequock River, 99 acres; Six Penny Island, Mason's Island, and Outer Mystic Harbor, 93 acres; and the Poquonock River, 65 acres.

Methods of preservation must of necessity be varied. They could include: (1) outright purchase by local or state agencies or private conservation groups, (2) purchase of development rights by governmental or private groups, (3) gifts of either land or development rights from conservation-minded

24/ Interview with Dr. John Rankin, Marine Research Laboratory, University of Connecticut and James Bishop, State Board of Fisheries and Game, 4 April 1963.

individuals, and (4) the use of local regulatory powers to prevent development in areas subject to tidal flooding.

Use of zoning to prohibit development on tidal marsh would be justifiable because of the hazard of flooding and the role of the marshes in absorbing the impact of storm waves. Only one community in the region, Groton, has zoned a marsh to prohibit intensive use, and this zone covers only 73 acres. A more widespread use of tidal marsh zoning appears to be a useful means of preserving marsh areas for at least the short-range future.

INTERIOR WETLANDS

Due largely to the broken topography and interrupted drainage pattern resulting from glaciation, Southeastern Connecticut has a large amount of interior wetland, or fresh water swamp. Nearly 22,000 acres of the region's 328,000-acre land area are classed as interior wetlands.

Interior wetlands are difficult to develop for intensive use but have a high conservation potential. Fresh water swamps, ranging from a wooded condition to open meadows, provide a favorable environment for waterfowl feeding and nesting. They are also of importance to upland game birds, small game, and deer as a wintering habitat or as feeding grounds. 25/

Aside from wildlife conservation, the interior wetlands are useful as natural catchment areas to absorb excessive rainfall, reducing the danger of flooding further down stream. Their potential for use as nature study or natural areas in an open space system is also quite high.

Through the cooperation of the State Board of Fisheries and Game, SCRPA has been able to obtain a preliminary evaluation of the value to waterfowl and other wildlife of the major interior wetlands in the region. 26/ A total of 99

25/ U.S. Department of the Interior, Fish and Wildlife Service. <u>Wetlands of Connecticut.</u> Boston, 1959, p. 13.

26/ This evaluation was completed by Milton C. Arnold and Mason S. Belden, Game Biologists for Districts III and IV.

interior wetlands were identified as being either of medium to high value to wildlife at present or having the potential of being improved to at least medium value. These wetlands are shown on Figure 10 on page 48 and described in detail in Table 4 on page 49.

The selected wetlands contain a total of 9,099 acres. Nearly half of this total is presently of high value to wildlife or has the potential of being raised to that level. Further study will be necessary to refine this preliminary evaluation.

All of the wetlands in the region are located on Class B land, which physically is the least suitable of our lands for future intensive development. In view of this, careful consideration should be given to retaining at least the highest value wetlands for conservation purposes.

SIGNIFICANT GEOLOGIC FEATURES

SCRPA's staff discussed the geology of the region with Dr. J.W. Peoples of Wesleyan University and Dr. J.B. Lucke of the University of Connecticut to identify any geologic feature deemed to be of particular scientific interest. The only feature felt to be of special interest is the "Ledyard Moraine."

First described by Richard Goldsmith, 27/ the Ledyard Moraine is a broken band of boulder accumulations and hummocky glacial deposits stretching in a southwesterly direction from Ledyard Center. The moraine passes near Gales Ferry, south of Uncasville, and has been traced as far as Pataguanset Lake in East Lyme.

The Ledyard Moraine marks a previously unrecognized halt of the last retreating ice sheet in New England. The rough nature of much of the moraine and its scientific interest suggest its consideration for park or some other open space use. Richard Goldsmith has suggested three locations along the moraine that represent key features and would

27/ Goldsmith, Richard. "A Post-Harbor Hill-Charlestown Moraine in Southeastern Connecticut," American Journal of Science, Vol. 258, No. 10, New Haven, Conn., Yale University, December, 1960, pp. 740 ff.

be suitable for park use. These sites in Ledyard and Waterford are shown on Figure 10.

Three additional features felt to merit consideration for preservation are: (1) Lantern Hill in North Stonington, which has historical as well as geologic interest, (2) Cochegan Rock in Montville, an unusually large boulder that is a hiking focal point, and (3) the eastern portion of Oswegatchie Hill in East Lyme, which offers excellent possibilities as a natural area for studying geology and plant ecology.

SOUTHEASTERN CONNECTICUT REGION

INTERIOR WETLANDS & GEOLOGIC FEATURES

LEGEND

- WETLANDS OF PRESENT OR POTENTIAL VALUE TO WILDLIFE (SEE TABLE FOUR FOR SITE DESCRIPTIONS)
- GEOLOGIC FEATURES OF SCENIC OR SCIENTIFIC INTEREST

701 PROJECT: CONN. P-30(G)

FINANCED IN PART THROUGH REGIONAL PLANNING GRANTS FROM THE HOUSING AND HOME FINANCE AGENCY AND THE CONNECTICUT DEVELOPMENT COMMISSION

FIGURE 10

PREPARED BY THE SCRPA STAFF – 1963

TABLE FOUR

INTERIOR WETLANDS OF HIGH - MEDIUM VALUE TO WILDLIFE

Southeastern Connecticut Region

WETLAND NUMBER	ACREAGE	PRESENT VALUE	POTENTIAL VALUE	OWNERSHIP
1	59	Medium	Medium	Park & Forest, Private
2	11	Low	Medium	Park & Forest
3	274	Low	High	Park & Forest, Private
4	145	Low	High	Park & Forest, Private
5	37	Medium	Medium	Park & Forest, Private
6	19	Medium	Medium	Private
7	28	Low	High	Private
8	51	Low	Medium	Park & Forest, Private
9	105	High	High	Park & Forest, Private
10	54	High	High	Park & Forest
11	87	Low	Medium	Park & Forest, Private
12	73	Low	High	Park & Forest
13	45	Low	Medium	Private
14	105	Low	Medium	Private
15	99	High	High	Private
16	97	Low	Medium	Private
17	115	Low	Medium	Water Company
18	45	Low	Medium	Private
19	44	Low	Medium	Private
20	81	Low	Medium	Private
21	54	Low	Medium	Private
22	39	Medium	Medium	Private
23	76	Medium	Medium	Private
24	83	Low	Medium	Private
25	43	High	High	Private
26	147	Medium	High	Private
27	285	Low	High	Private
28	111	Medium	High	Private
29	95	Low	Medium	Private
30	32	Medium	Medium	Private
31	48	Medium	Medium	Water Company
32	71	Low	High	Private
33	84	Low	High	Private
34	59	Low	Medium	Private
35	86	Low	Medium	Private
36	34	Low	Medium	Private
37	32	Medium	Medium	Private
38	250	Low	Medium	Private
39	114	High	High	Private
40	118	Low	Medium	Private
41	64	Low	Medium	Private
42	95	Low	Medium	Private
43	59	Medium	Medium	Park & Forest

Table Four, Cont'd.

WETLAND NUMBER	ACREAGE	PRESENT VALUE	POTENTIAL VALUE	OWNERSHIP
44	35	Low	High	Private
45	70	Low	High	Park & Forest
46	34	Low	Medium	Private
47	32	Low	Medium	Private
48	21	Medium	Medium	Private
49	50	Medium	Medium	Private
50	221	Medium	Medium	Private
51	78	Medium	Medium	Private
52	286	High	High	Park & Forest
53	10	Medium	Medium	Private
54	536	Low	Medium	Private
55	101	Low	Medium	Private
56	57	Low	Medium	Private
57	101	Low	Medium	Private
58	114	Medium	High	Private
59	40	Medium	Medium	Private
60	66	Low	Medium	Private
61	41	High	High	Private
62	75	Medium	Medium	Private
63	64	Medium	Medium	Private
64	28	High	High	Private
65	18	Medium	High	Private
66	83	High	High	Private
67	37	Medium	Medium	Private
68	101	High	High	Private
69	110	Low	Medium	Private
70	18	High	High	Private
71	64	High	High	Private
72*	1,056	Medium	High	Private
73	28	High	High	Private
74	55	High	High	Private
75	46	High	High	Private
76	129	Medium	Medium	Private
77	28	Medium	Medium	State Forest
78	64	Medium	Medium	Private
79	9	Medium	High	Private
80	184	Low	High	Private
81	9	Medium	Medium	State Forest
82	73	High	High	Private
83	46	Low	High	Private
84	46	High	High	State Farm for Women
85	55	High	High	Private
86	28	High	High	Private
87	46	Medium	Medium	Private
88	92	Medium	Medium	Private
89	37	High	High	Private
90	83	Medium	Medium	Private

Table Four, Cont'd.

WETLAND NUMBER	ACREAGE	PRESENT VALUE	POTENTIAL VALUE	OWNERSHIP
91	83	High	High	Private
92	55	Medium	Medium	Private
93	129	High	High	Bates Woods & Private
94	147	Medium	Medium	Private
95	82	Medium	High	Private
96	109	Medium	High	Private
97	48	Medium	High	Private
98	86	Low	Medium	Private
99	102	Medium	Medium	Private
TOTAL	9,099			

* This site contains some upland areas as well as wetland.

Source: Preliminary survey by Milton C. Arnold and Mason S. Belden, Game Biologists with the State Board of Fisheries and Game.

SUMMARY OF MAJOR FINDINGS

PRIME AGRICULTURAL LAND

1. There are 33 square miles of prime agricultural land in the region.

2. The economic feasibility of attempting to maintain agriculture as a major land use in Southeastern Connecticut will require additional study.

POTENTIAL RESERVOIR SITES

1. Present and planned reservoirs owned by existing companies have a dependable yield of 27.6 million gallons per day.

2. Development of the 25 most highly rated potential reservoir sites could provide a total regional water supply of 143 million gallons per day.

3. The estimated regional water need by 2010 is 75 - 114 million gallons per day to serve a population of 380,000.

TIDAL MARSHES AND ESTUARIES

1. Tidal marshes and estuaries are important food sources for marine life, reduce the intensity of storm waves, and have obvious scenic and recreational potentials.

2. The region has 1,100 acres of scattered tidal marsh, two-thirds of which is in private ownership or controlled by agencies with no conservation role.

3. The larger complexes of marsh appear to offer the best potential as open space.

INTERIOR WETLANDS

1. There are 22,000 acres of interior wetlands (fresh water swamps) in Southeastern Connecticut.

2. Interior wetlands have a high conservation value to wildlife and are valuable natural catchment areas to absorb excessive rainfall.

3. 9,099 acres of the region's interior wetlands now are or could become of medium to high value to wildlife.

SIGNIFICANT GEOLOGIC FEATURES

1. Five areas of geologic interest have been identified: 2 in Ledyard, 1 in North Stonington, 1 in Waterford, and 1 in East Lyme. These areas could form interesting segments of a regional open space system.

V. APPENDIX

Data On Land Characteristics And Land Use For Communities In The Southeastern Connecticut Region

DEFINITIONS of items appearing in the following tables:

Developed Land - consisting of residential, commercial and industrial, institutional and governmental, and utilities and transportation uses.

Public Open Space - comprising State preserves, water reservoir sites, and intensive recreational facilities such as parks, golf courses, camps, etc.

Undeveloped Land - includes all land which is not classified as Developed Land or Public Open Space. It consists of all agricultural lands, privately owned woodlands, swamps, and any other vacant land.

Class A - undeveloped lands which present no major physical obstacles to intensive development. The land surface is generally level, with no slope greater than 10%. Soils are well or moderately well drained with generally permeable substrata.

Class B - undeveloped lands which has certain physical limitations for more intensive development. This category includes areas with slopes exceeding 10%, shallow to bedrock soils, poorly drained mineral soils, swamps and bogs, tidal marshes, or coastal beaches and dune sand.

1. BOZRAH

		Acres
Developed Land		390
Public Open Space		62
Undeveloped Land		12,193
Class A	4,170	
Class B	8,023	
Total Land Area		12,645

2. EAST LYME

Developed Land*		3,821
Public Open Space		1,745
Undeveloped Land		17,888
Class A	4,636	
Class B	13,252	
Total Land Area		23,454

* Includes 32 acres of vacant land in small, scattered parcels within the urbanized area, which did not warrant evaluation of physical characteristics.

3. FRANKLIN

		Acres
Developed Land		297
Public Open Space		51
Undeveloped Land		12,195
Class A	4,569	
Class B	7,626	
Total Land Area		12,543

4. GRISWOLD

Developed Land*		841
Public Open Space		3,092
Undeveloped Land		18,467
Class A	8,038	
Class B	10,429	
Total Land Area		22,400

* Includes 30 acres of vacant land in small, scattered parcels within the urbanized area, which did not warrant evaluation of physical characteristics.

5. GROTON

		Acres
Developed Land*		5,568
Public Open Space		1,234
Undeveloped Land		12,142
Class A	4,728	
Class B	7,414	
Total Land Area		18,944

6. LEDYARD

Developed Land		1,758
Public Open Space		1,424
Undeveloped Land		21,906
Class A	8,875	
Class B	13,031	
Total Land Area		25,088

* Includes 878 acres of vacant land in small, scattered parcels within the urbanized area, which did not warrant evaluation of physical characteristics.

7. LISBON

		Acres
Developed Land		532
Public Open Space		67
Undeveloped Land		10,089
Class A	3,374	
Class B	6,715	
Total Land Area		10,688

8. MONTVILLE

Developed Land		1,818
Public Open Space		1,827
Undeveloped Land		24,003
Class A	10,984	
Class B	13,019	
Total Land Area		27,648

9. NEW LONDON

		Acres
Developed Land *		2,472
Public Open Space		271
Undeveloped Land		754
Class A	279	
Class B	475	
Total Land Area		3,497

10. NORTH STONINGTON

Developed Land		618
Public Open Space		2,559
Undeveloped Land		32,090
Class A	12,644	
Class B	19,446	
Total Land Area		35,267

* Includes 427 acres of vacant land in small, scattered parcels within the urbanized area, which did not warrant evaluation of physical characteristics.

11. NORWICH

		Acres
Developed Land*		4,441
Public Open Space		1,352
Undeveloped Land		12,206
Class A	5,085	
Class B	7,121	
Total Land Area		17,999

12. PRESTON

Developed Land		820
Public Open Space		14
Undeveloped Land		18,942
Class A	6,956	
Class B	11,986	
Total Land Area		19,776

* Includes 404 acres of vacant land in small, scattered parcels within the urbanized area, which did not warrant evaluation of physical characteristics.

13. SALEM

		Acres
Developed Land		421
Public Open Space		1,433
Undeveloped Land		16,384
Class A	5,110	
Class B	11,274	
Total Land Area		18,238

14. SPRAGUE

Developed Land		477
Public Open Space		507
Undeveloped Land		7,464
Class A	3,165	
Class B	4,299	
Total Land Area		8,448

15. STONINGTON

		Acres
Developed Land*		2,529
Public Open Space		1,129
Undeveloped Land		21,494
Class A	9,337	
Class B	12,157	
Total Land Area		25,152

16. VOLUNTOWN

Developed Land		343
Public Open Space		13,658
Undeveloped Land		11,215
Class A	5,695	
Class B	5,520	
Total Land Area		25,216

* Includes 80 acres of vacant land in small, scattered parcels within the urbanized area, which did not warrant evaluation of physical characteristics.

17. WATERFORD

		Acres
Developed Land		2,557
Public Open Space		697
Undeveloped Land		18,122
Class A	6,714	
Class B	11,408	
Total Land Area		21,376

18. TOTAL FOR SOUTHEASTERN CONNECTICUT REGION

Developed Land*		29,703
Public Open Space		31,122
Undeveloped Land		267,554
Class A	104,359	
Class B	163,195	
Total Land Area		328,379

* Includes 1,851 acres of vacant land in small, scattered parcels within the urbanized area, which did not warrant evaluation of physical characteristics.